

Khadjavi, Menusch; Sipangule, Kacana; Thiele, Rainer

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Regular Research Article

Exposure to large-scale farms increases smallholders' competitive behavior and closes the gender gap

Menusch Khadjavi^{a,c,*}, Kacana Sipangule^{b,c}, Rainer Thiele^c^a Department of Spatial Economics, School of Business and Economics, Vrije Universiteit Amsterdam, the Netherlands^b School of Business and Economics, Vrije Universiteit Amsterdam, the Netherlands^c International Development Research Center, Kiel Institute for the World Economy, Germany

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ABSTRACT

We investigate how exposure to large-scale farms affects smallholders' competitive behavior. Based on lab-in-the-field experimental measures covering more than 900 smallholders and 400 children in Zambia, we find that smallholders who are traditionally dependent on subsistence agriculture behave more competitively when they are located close to large-scale farms. This effect is especially pronounced for female smallholders and closes the gender gap associated with competitiveness. This result replicates for their children. We identify female employment and shifting intra-household tasks as a possible mechanism. Our results provide new insights for understanding how changes in societal arrangements like market integration influence economic behavior.

1. Introduction

Competitiveness is a key component of success in modern market economies. Firms compete for customers, employees compete for positions, politicians compete for voters, and students compete for university placements. The origins of individual competitiveness have been of great interest for economists in recent years. The literature shows that differences in competitive behavior already exist among children and depend on parental backgrounds and attitudes (Almas et al., 2016; Chowdhury et al., 2022; Falk et al., 2021; Khadjavi and Nicklisch, 2018; Sutter et al., 2019). Beyond parental influences, behavioral economic research suggests that societal arrangements influence individuals' preferences for competition, especially gender differences (Andersen et al., 2013; Buser et al., 2014; Croson and Gneezy, 2009; Niederle and

Vesterlund, 2007; Gneezy et al., 2003; Gneezy et al., 2009; Hoffman et al., 2011; Leibbrandt et al., 2013; Sutter and Glätzle-Rützler, 2015).

Most changes in societal arrangements, like the extent of gender equality and market integration, happen endogenously and over long time horizons. For instance, Henrich et al. (2001, 2004, 2010) and Henrich and Ensminger (2014) provide compelling evidence that market exposure correlates with pro-social behavior in small-scale societies. With regard to gender differences, Alesina et al. (2013) show that present day norms and beliefs on gender equality are greatly influenced by the adoption of traditional agricultural practices such as the historical use of ploughs. Likewise, Gneezy et al. (2009) and Andersen et al. (2013) provide evidence on differences in competitiveness in matrilineal and patriarchal societies. Leibbrandt et al. (2013) show how work arrangements based on natural circumstances influence competitiveness while

* Corresponding author at: Vrije Universiteit Amsterdam, Department of Spatial Economics, School of Business and Economics, De Boelelaan 1105, 1081 HV Amsterdam, the Netherlands.

E-mail address: m.khadjavipour@vu.nl (M. Khadjavi).

Siddique and Vlassopoulos (2020) find that ethnicity is an important determinant of competitive preferences.

All these findings yield valuable insights into the emergence and endogenous development of competitive preferences through changes in long-term societal arrangements (Bowles, 1998). The aim of this study is to complement previous findings of mostly long-term effects with a shorter term exogenous effect and investigate additional transmission mechanisms more closely.¹

Our study takes advantage of an exogenous change over a short time period that has affected small-scale farmers in a number of developing countries: exposure to large-scale farms in the vicinity of smallholders. Following the threefold fuel, food and financial crises of the years 2008 to 2009, investors from multinational agricultural firms have invested in farmland in developing countries. Since the crisis, more than 2500 deals that cover an area of approximately 96 million hectares (an area far greater than the size of Turkey) have been concluded (Nolte et al., 2016).² Being market-oriented, highly mechanized, and capital intense, these large-scale farms often acquire land next to smallholder farmers that typically have low productivity levels, limited access to markets, and are subsistence-oriented. This situation mirrors the encounter of two classic antithetical paradigms of rural farming and economic development, where the small-scale farmers represent a communal peasant economy and the large-scale farm represents the modern market economy (Timmer, 1997).

Several studies have already documented spillovers that arise when these two antithetical paradigms of rural farming and economic development interact. For instance, Lay et al. (2021) report that smallholder livelihoods may be affected through infrastructure development, access to input and output markets, technology spillovers, direct income effects linked to employment creation and increased local economic activity and demand. The authors find that smallholders located next to large-scale farms in Zambia switch to primarily growing maize and obtain higher maize yields. Wineman et al., (2021) find that small-scale farmers in Tanzania alter their behavior and have improved agricultural outcomes when they are located around large- and medium scale farms. Examples of the improved agricultural outcomes they observe are the use of agricultural seed, proportion of land cultivated and an increased likelihood to accept agricultural extension services. Using data from Kenya and Zambia, Sitko et al. (2018) show that regions with clusters of medium-scale farmers also attract a high number of large-scale traders that enable small-scale farmers to sell their output at higher and more competitive prices. For Malawi (Deininger and Xia, 2018; Herrmann and Grote, 2015) analyze the effects on the tea and sugar estate on smallholders whilst insights from Nigeria are provided by Liverpool-Tasie et al. (2023).

While these studies mostly focus on the direct and measurable effects of the interaction between medium- and large-scale farms on smallholders, it is likely that smallholders' behavior and preferences are also affected through this interaction. In this study, we add to the literature on behavioral implications of large-scale farms by investigating how the competitive behavior of small-scale farmers is altered by the establishment of large-scale farms. To this end, we employ the lab-in-the-field experimental measure introduced by Gneezy et al. (2009). More specifically, we analyze the decisions to compete made by 442 small-scale farmers in 13 randomly selected villages located within a 15-

kilometer radius of two large scale-farms and compare them with the decisions to compete of 484 similar small-scale farmers from 16 randomly selected villages that are located 50–75 km further away from the two large-scale farms.³ Our central hypothesis is that exposure to large-scale farms leads to more competitive behavior of small-scale farmers.⁴

The results provide strong evidence in favor of this hypothesis. We especially find that female smallholders that have experienced exogenous exposure to large-scale farms are more willing to compete than those that have no such exposure. Interestingly, male smallholders' competitive behavior is determined by endogenous market integration through crop sales and not (additionally) by exposure that occurs after large-scale farms were established. Hence, male smallholders appear to have already been exposed to factors that raise their competitive behavior such as better access to assets and prevailing patrilineal norms. In communities near large-scale farms, females' competitive behavior is raised to the extent that the gender gap in competitiveness is closed. These results are further corroborated by a comparison of the competitive behavior of 400 children (aged 5–15) from the two sets of villages situated near and further from the large-scale farms. We find that children living in villages close to large-scale farms are significantly more competitive than their counterparts in villages further away. A follow-up survey on the division of intra-household tasks reveals female engagement in paid employment and associated childcare by men as a plausible mechanism that closes the gender gap. This finding underlines the importance of paid female employment in alleviating gender-stereotypical preference development over time.

2. Study context

The study was conducted in the Mumbwa and Mkushi districts of Zambia's Central Province. These two districts were selected as they both have large-scale farms that were recently set up in the proximity of small-scale farming communities. The large-scale farm in Mumbwa was allocated an area of over 30,000 ha when it began its operations in 2012. It cultivated nearly one tenth of this land, at the time of data collection. The land acquired by the large-scale farm was titled state land in the Mumbwa Big Concession Farm block that was owned by private individuals, but largely underdeveloped to the extent that it resembled a typical rural agrarian context where local communities derived their main livelihoods from small-scale farming (Chu and Phiri, 2015). The large-scale farm in Mkushi was set up in 2010 in the Mkushi farm block. It consists of 6 smaller farms that together account for approximately 4000 ha. These farms can be considered very large for a country like Zambia where close to 90 percent of farmers cultivate less than 5 ha of land and around 6 percent cultivate plots of land that range between 5 and 10 ha (Lay et al., 2021). The two large-scale farms both operate in competitive market environments and seek to become major suppliers of wheat and maize for Zambia and neighboring countries. The two farms are representative of other large-scale farms in Zambia and sub-Saharan Africa in a number of regards: they are similar in size, cultivate similar crops, were set up at almost the same time and target the same markets as other farms of the same magnitude (Harding et al., 2016; Khadjavi et al., 2021).

This competitive environment driving the two large-scale farms contradicts the conditions facing neighboring small-scale farmers who are mostly reliant on low-productive, rain-fed agriculture. Small-scale

¹ One of the few studies that investigate how competitive preferences are shaped by a relatively short-term (one generation) societal change is by Booth et al. (2019), who analyze how social norms for different birth cohorts in mainland China and Taiwan have been influenced by the adoption of capitalist market-oriented reforms and Marxist ideology over a period of four decades. In another paper that investigates short-term societal arrangements, Zhang (2019) compares how gender-egalitarian communist institutional reforms that are influenced the inclination of females to compete.

² The website <https://landmatrix.org/> provides current numbers.

³ The data for our analyses were collected as part of the same experimental sessions as those reported in the companion paper on social capital (Khadjavi et al., 2021).

⁴ While this research was conducted when pre-registration was not the norm, we formulated our main hypothesis in the project proposal to the IGC before getting funding and running our study. We are open to share this information upon request.

farmers' competition and full market participation is hindered, for instance, by their limited access to productive assets (Deininger and Olinto, 2000). Literature on smallholder market competitiveness is limited, one of the few studies that analyses market participation in Zambia is Chapoto and Jayne (2011). Using data from the crop forecast survey in 2010/2011, they find a positive correlation between surplus maize production and the number of traders that visit villages to purchase maize output. They point out that provinces that experienced a surplus production such as Central Province were visited by 7.4 to 9 traders which increased competition for village-level maize buying. Proximity to feeder roads also increases the attractiveness of remote villages for traders. Interestingly, the authors also find that most smallholders (over 60 per cent) sold their produce directly on their farms or within short distances, smallholders with more produce (10 per cent) pursued a deliberate marketing strategy that led them to travel longer distances to sell their output to millers and brewers. It is likely that smallholders that sold their output across these different settings i.e. on their farms, at short and long distances faced different degrees of market competition.

Our study setting provides an interesting case for us to examine how the exogenous exposure to competitive, highly productive and market-oriented large-scale farms affects small-scale farmers' preferences for competition. We posit that exposure to market-oriented large-scale farms will increase small-scale farmers' individualism and willingness to participate on the market as has been found in previous research conducted in Central Zambia (Kajoba, 1994). Since competitive behavior can be regarded as a key ingredient for success in market economies we expect that small-scale farmers that have been exposed to large-scale farms will develop more competitive behavior.

Moreover in line with (Chapoto and Jayne, 2011), we also expect that those small-scale farmers who have already had some degree of endogenous market engagement through the sale of their produce will be more accustomed to competition and will hence display a higher willingness to compete. Thus, in the context of our study, we expect that exposure to large-scale farms and market engagement, through crop sales, increase competitive behavior of smallholders. Competitive behavior in smallholders is important as it may motivate them to produce higher crop yields (which can result in improved livelihoods) and to foster their aspirations to achieve careers beyond traditional small-scale farming.

3. Experimental design and procedures

We visited 29 randomly selected Zambian villages in August and September 2015. The villages were randomly selected using maps and village lists provided by the Zambian Statistics Agency (ZamStats) in Lusaka. 13 villages within a radius of 15 km from the center of the two large-scale farms (*near* villages) and 16 villages (*further* villages) within a 50- to 70-kilometer radius from the large-scale farms were selected (see Fig. 1a and 1b).

Once the *near* and *further* villages were identified, village heads were approached to request permission to conduct our study in their villages. We presented a support letter that we had received from the Zambian Central Province administration.⁵ The village headwomen and -men were asked to invite all adults in the village to participate in an incentivized study that sought to analyze socio-economic conditions in the village.⁶ A total of 926 adults participated in our study – 442 participants in *near* villages and 484 in *further* villages.

In order to elicit the impact of exogenous large-scale farm exposure on participants' competitive behavior, we employed the incentivized

competition game of Gneezy et al. (2009).⁷ This game was selected due to its simplistic nature that makes it suitable for a setting such as ours where more than half of the study participants could not read or write well in English or in the main regional languages (Nyanja or Bemba). In addition to being simple, the game is well-suited for such a setting as the task (tossing ten tennis balls into a bucket with an underhand toss) is unfamiliar to the participants.

Before tossing the balls, participants were asked to decide between two options: Option A and Option B. Option A meant that the participant earned 5 Zambian Kwacha (approx. \$0.50 at the time of the study) for each successful toss into the bucket.⁸ Option B paid 15 Zambian Kwacha (approx. \$1.50) for each successful toss (the threefold amount of Option A) to the participant, but only if the participant tossed more tennis balls into the bucket than an anonymous randomly matched participant from the other group in the same village. Hence, the payment in Option A was a piece rate that was independent of other participants' success while the payment in Option B was a combination of a piece rate and a reward for competition. If a participant tossed fewer balls into the bucket than the other participant, then she received no money in the game under Option B.⁹ In case of equal scores, Option B yielded 5 Zambian Kwacha for each successful toss (just like Option A).¹⁰ Ten successful tosses could earn the participants 150 Zambian Kwacha. The potential payoffs from competing can be considered to be very high since the average rural per capita monthly income was estimated at 185.9 Zambian Kwacha during the period in which the study was conducted (CSO, 2016).

After participants individually decided on the option and tossed the tennis balls, they were directed to a spatially separate waiting area. This measure ensured that neither the two groups nor participants within each group could communicate about the task, their decisions or scores. Great caution was undertaken to ensure that all tosses were made in secluded areas with natural barriers to block other participants from learning about the scores of their companions. Fig. 2 illustrates the setup.

Given the great interest in the development of economic preferences in children (e.g. Almas et al., 2016; Buser et al., 2014; List et al., 2023; Sutter et al., 2019), we used the opportunity of being in the villages to investigate whether children's competitive behavior is also altered by adults' exposure to large-scale farms. As the experiment with adults was the main focus and we did not want to disturb children's schooling or other activities, we did not preannounce this part of our data collection. Rather, we invited all children who were present during our data collection and aged between at least five and maximal twelve years to participate, if there was at least one (grand)parent present who consented to the participation. We adjusted the nature of the payoffs so that they were no longer monetized. The incentive structure for children was the same, except that they earned 1 (Option A) or 3 marbles (Option B,

⁷ The competition game was the third and last game, after a sequential prisoner's dilemma to measure social capital and a deception game. There was no feedback regarding the first and second game before the competition game was completed. Khadjavi et al. (2021) provide further information on the results from the sequential prisoner's dilemma.

⁸ A toss was considered successful if the tennis ball remained in the bucket and did not bounce out.

⁹ Competition games typically involve trade-offs that are associated with risk-taking, confidence and a preference to compete. Seminal studies identify competitiveness as a distinct preference (Niederle and Vesterlund, 2007; Croson and Gneezy, 2009; Niederle, 2017; Saccardo et al., 2018). Studies use different methods to measure the relative importance of confidence and risk preferences for and their distinction from competitiveness (e.g. Cardenas et al., 2012; van Veldhuizen, 2022; Lozano and Reuben, 2023).

¹⁰ Appendix B contains the instructions of our study.

⁵ Appendix D contains the support letter.

⁶ The village heads were informed that participation is strictly voluntary and that participants will receive a payment. The village heads and our research assistants were completely unaware of our hypotheses.

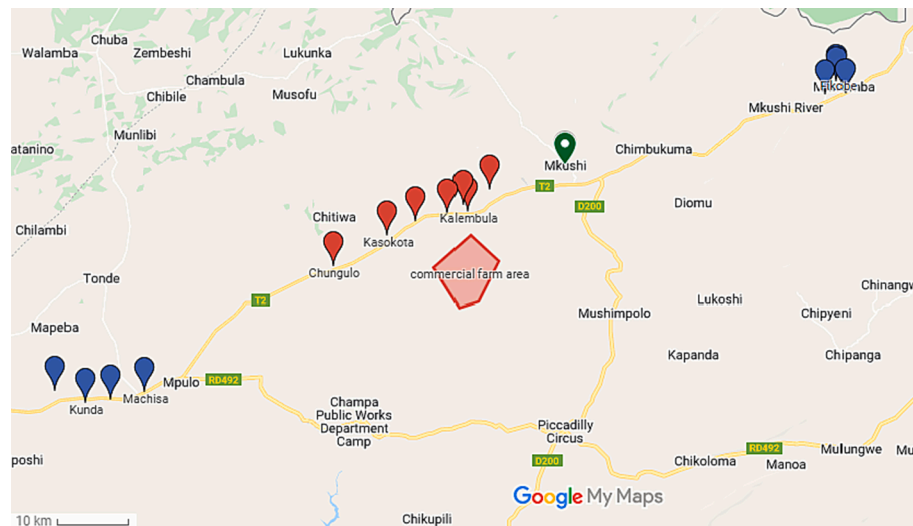


Fig. 1a. Near (red) and further (blue) villages in Mkushi districts. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

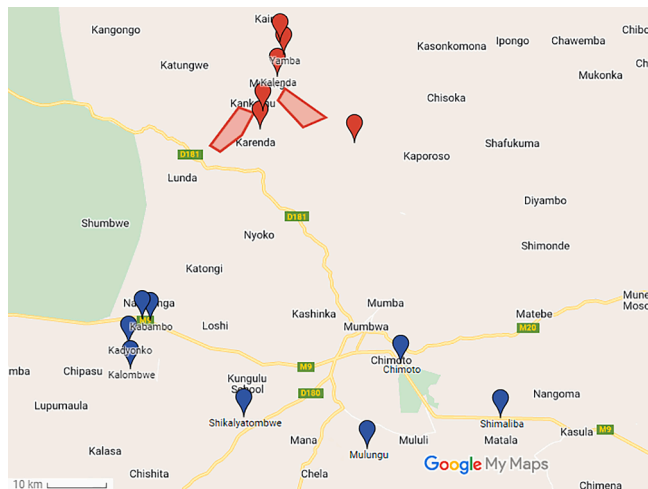


Fig. 1b. Near (red) and further (blue) villages in Mumbwa districts. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

same condition as above) for each successful toss. Marbles themselves are valuable to children as they can be used to play traditional games such as *Nsola* (a local variant of the popular board game Mancala).¹¹ The children were informed that they could retain the marbles or exchange them for other toys and school stationery (at exchange rates mirroring market prices). 401 children between the ages of 5 and 15 participated in our competition game. Children were only allowed to participate after their parents or guardians had granted permission.

Recognizing that it would be extremely difficult and costly to design such a study within a panel setting that tracks the evolution of competitive behavior before and after the establishment of a large-scale farm, we undertake a thorough investigation to ensure that the *further* villages are a good counterfactual for the *near* villages.

¹¹ Marbles have also been used as a form of payment for children in other experimental studies that sought to elicit children competitiveness, for instance see Madsen (1971).

First, we compare the possible determinants of smallholders' competitive behavior prior to the establishment of the large-scale farms. As discussed above, smallholders' competitive behavior can be influenced by their degree of market engagement. In Table 1, we compare geographic and population data of the regions where the *further* and *near* villages are located. This geographic and mapping data was all sourced from time periods prior to the set-up of the large-scale farms. The sources of this data are listed in Note 2 below Table 1. We find that factors that could affect smallholders' agricultural productivity and subsequently their market engagement, such as population density, rainfall and access to infrastructure, do not differ significantly between *near* villages and *further* villages.

Second, we compare smallholders' and village level characteristics after the establishment of the large-scale farms and only find significant differences in the mean age of smallholders, in the number of smallholders that have worked on large-scale farms as well as the number of smallholders engaged in crop sales. However, these differences are not surprising as it can be expected that there is a larger number of farm workers¹² in the vicinity of large-scale farms and a higher number of smallholders engaged in crop sales further away from the large-scale farms since alternative employment and cash income opportunities are unavailable. Importantly, we do not find any significant differences across gender, ethnicity and whether the village has a patrilineal lineage. These variables have been identified in the literature as key determinants of competitive preferences (Croson and Gneezy, 2009; Siddique and Vlassopoulos, 2020; Gneezy et al., 2009). Third, we collected soil samples from all the villages visited to test whether differences in soil quality could influence the location of large-scale farms and the general behavior of smallholders. Differences in soil quality (organic carbon, pH levels and soil trace elements) were not found (see also Khadjavi et al., 2021).

Fourth, we conducted interviews with the Investment Promotions Officer at the Zambian Development Agency (ZDA) – which is the agency charged with promoting and facilitating investments – to find out what general criteria is taken into consideration before the establishment of such large-scale farms and with managers of the two large-scale farms. The Investments Promotions Officer informed us that large-scale farm managers are generally required to inform the ZDA about

¹² Separating these figures by gender, we see higher numbers in *near* villages for both males (60.3% vs. 29.2%) and females (45.9% vs. 20.7%).



Fig. 2. The competition game environment in the field: a participant (standing) tossing a tennis ball, one of the research assistants (sitting) noting down the score.

their planned agricultural activities with details of the crops to be grown, livestock to be bred, the requested size, and planned irrigation activities. Information about the topography, soil suitability, land tenure system and land capability are also essential in deciding whether to establish a large-scale farm or not. While the information provided by ZDA was insightful in highlighting the key attributes sought by investors as they acquire land for large-scale farms, it neglected the complexities associated with acquiring farm land that may fall under customary title or may already be in use by smallholder despite existing title. The interviews with the large-scale farm managers revealed that both large-scale farms were established on titled state land with some key differences. The land acquired by the large-scale farm in Mkushi was part of a farm block already used for large-scale agricultural production while the land in Mumbwa was reserved under the Big Concession farm block but had not yet been used for commercial agricultural purposes and resembled a typical rural agrarian context with small-scale farming being the most dominant form of agriculture. This information has been corroborated by other scholarly works (see for instance, [Chu and Phiri, 2015](#); and [Nolte and Subakanya, 2016](#)). These interviews and previous research point out that while the process of land acquisition may have been more complex than elaborated by the ZDA, it is not likely that small-scale farmers in the vicinity of these large-scale farms were engaged in competitive agriculture.

Fifth, to make sure that other forms of market engagement were not driving the results we kept access to roads constant across both sets of villages. None of these additional cautionary measures revealed that small-scale farmers in *near* villages are systematically different from their counterparts in *further* villages. Importantly, further identification details and robustness checks can also be found in a companion article on social capital ([Khadjavi et al., 2021](#)).

4. Results

We first report the results of the lab-in-the-field experimental measure with the adult participants. This is followed by the results of the

same experimental measure with children aged 5 to 15 years old in a subset of villages.¹³

4.1. Adults

In line with our central hypothesis, we indeed find that participants in *near* villages are more likely to choose the competitive option (54.36 percent) when compared to participants in *further* villages (47.75 percent). This difference of about 14 percent is statistically significant based on a two-sided Fisher exact test ($p < 0.05$). Note also that the share of competitive choices in *near* villages is greater than chance (binomial test, $p < 0.05$). [Fig. 3](#) depicts this result.¹⁴

Given the rich data collected in the survey, we investigate whether the results presented in [Fig. 3](#) still hold after controlling for individual, household and village level socio-economic observables. We also include a variable that indicates whether a participant sells crops as our proxy for market engagement and estimate a logit regression of the following form:

$$y_i = \alpha_i + \beta_1 \tau_v + \beta_2 \mu_i + \beta_3 \chi_{ihv} + \beta_4 \rho_r + \varepsilon_{ihv}$$

where y_i represents the individual's decision to choose the competitive option, τ_v is a dichotomous variable equal to 1 for *near* villages, μ_i is a variable that indicates whether an individual engages in crop sales, and χ_{ihv} is a vector of individual, household and village-level socio-economic variables. ρ_r is used to control for any region-specific effects while ε_{ihv} is the error term. As a robustness check we replace τ_v with a continuous

¹³ We reserved between four and five hours in a village to collect all decisions and survey information from adults, in order to be able to collect data in two villages per day. Where time permitted it, we collected the competition decisions of the children as well.

¹⁴ See [Fig. A.1 in Appendix A](#) for histograms of competition game scores in our two village groups. A Kolmogorov-Smirnov test cannot reject the null hypothesis of equal distributions in the two village groups ($p > 0.1$).

Table 1
Summary statistics by village type.

Variable	<i>near villages</i>		<i>further villages</i>		p-values
	Mean	SD	Mean	SD	
<i>Individual and household characteristics</i>					
Household head (1 = yes)	0.46	0.09	0.49	0.13	0.32
# of household members	6.35	0.81	7.11	1.08	0.07
Male (1 = yes)	0.55	0.15	0.47	0.12	0.12
Age	35.07	2.46	41.11	5.25	0.00
Years in education	6.56	1.08	6.52	0.86	1.00
Large scale farm worker (1 = yes)	0.52	0.26	0.24	0.18	0.00
Recently migrated to the village (1 = yes)	0.20	0.16	0.17	0.13	0.68
Asset index ¹	0.42	0.03	0.41	0.10	0.46
Land title (1 = yes)	0.35	0.29	0.31	0.29	0.66
Crops sold (1 = yes)	0.68	0.61	0.82	0.10	0.03
Crop index	0.21	0.06	0.20	0.06	0.46
<i>Village characteristics</i>					
Village size (hectares)	413.00	579.19	1112.56	2069.41	0.90
Ethnic groups in village	8.46	3.31	7.84	3.11	0.55
Village is patrilineal (1 = yes)	0.15	0.38	0.38	0.50	0.19
<i>Pre-treatment village characteristics</i>					
Population density (pixel)	5.50	0.52	5.54	0.52	0.85
Population density (pixel from 5 km buffer)	5.50	0.52	5.54	0.51	0.74
Mean monthly rainfall (pixel)	81.29	3.32	80.05	5.59	0.47
Mean monthly rainfall (pixel from 5 km buffer)	81.26	3.05	80.18	5.73	0.51
Elevation (pixel)	1213.85	28.82	1250.63	140.12	0.83
Elevation (pixel from 5 km buffer)	1221.39	28.56	1252.24	132.78	1.00
Mean monthly maximum temperature (pixel)	30.47	0.49	30.08	1.32	0.98
Mean monthly maximum temperature (pixel from 5 km buffer)	30.42	0.50	30.08	1.25	0.86
Distance to nearest road (km)	0.49	0.61	1.54	2.14	0.20
Distance to nearest water line (km)	1.97	1.13	1.79	1.83	0.33
Distance to nearest rail (km)	71.90	77.57	63.82	65.45	0.20

Note 1: The p-values are based on two-sided Mann-Whitney tests on the village-level.

Note 2: The population density data is from the year 2000 and was compiled by the Center for International Earth Science Information Network (CIESIN). The precipitation and temperature data are sourced from the WorldClim database. They show the mean monthly maximum temperature and precipitation for the period between 1960 and 1990. The elevation data is from the Consultative Group on International Agricultural Research- Consortium for Spatial Information (CGIAR-CSI), SRTM30 dataset collected in 2000. The distance variables are vectors lines that were originally compiled for the Digital Chart of the World in 1992. All grid data have a high resolution of 30 s. The elevation, land cover, roads, railroads, water line, climate and population density data were all downloaded from the DIVA-GIS website: <https://www.diva-gis.org/gdata>.

¹ The asset index includes information on the households' possessions of livestock holdings, radios, agricultural equipment, transportation, as well indicators of the quality of housing. Asset indices are commonly used indicators of wealth and income in research in rural, low-income contexts as monetary income is less prevalent (e.g. Filmer & Pritchett, 2001; Sahn and Stifel, 2003; Filmer & Scott, 2012). Our asset index was created using a principal component analysis of all assets included in our survey. The list of assets can be found in Table A6 in the appendix. The asset index includes information on the households' possessions of livestock holdings, radios, agricultural equipment, transportation, as well indicators of the quality of housing. Asset indices are commonly used indicators of wealth and income in research in rural, low-income contexts as monetary income is less prevalent (e.g. Filmer & Pritchett, 2001; Sahn and Stifel, 2003; Filmer & Scott, 2012). Our asset index was created using a principal component analysis of all assets included in our survey. The list of assets can be found in Table A6 in the appendix.

variable δ_v measuring the distance from the large-scale farm to the villages. Since the outcome variable y_i is dichotomous, we estimate all specifications with logit regressions and report the marginal effects in the tables below.

We find consistent evidence that competitive behavior is more frequent in *near* villages after estimating different specifications that introduce controls for individual and village-level socioeconomic characteristics (columns I, II and III in Table 2). We also find that smallholders who sell crops on markets are significantly more competitive than those who do not engage in such crop sales. Interestingly, (1) proximity, i.e. the effect of living close to large-scale farms, and (2) market engagement, i.e. selling crops at markets, affect competitiveness jointly. We therefore find evidence that both endogenous market engagement (selling crops on markets) and proximity to large-scale farms (the exogenous settlement of agricultural investments next door) increase competitiveness.¹⁵

In addition, we find that being in a patrilineal village increases participants' willingness to compete. This is in line with Gneezy et al. (2009), who use the same game and show that nurture in matrilineal and patriarchal settings plays a significant role in shaping competitive preferences. We included Regression III in Table 2 to examine the robustness of the *near* large-scale farm effect (which remains significant and of similar size) when omitting the crop-sale variable. We were also curious to examine whether the asset index, which is correlated with the crop-sale variable (pairwise correlation of 0.2024, $p < 0.01$), will turn significant in Regression III. This is not the case,¹⁶ so that more assets predict crop selling which in turn predicts the decision to compete. As the asset index is not correlated with competitiveness, this suggests that risk-taking is not the main mechanism through which our effect works, because risk-taking should vary with wealth.¹⁷ Rather, our effect appears to be driven by a distinct preference for competition, as identified by Croson and Gneezy (2009), Cárdenas et al. (2012), Niederle (2017) and Lozano and Reuben (2023), for example.

Surprisingly, in contrast to previous studies (e.g. Croson and Gneezy, 2009; Booth et al., 2019), we do not find that gender influences competitive behavior. This null result on gender is surprising in the context of rural Zambia where differences in gender equality are pronounced (Evans, 2017; Kajoba, 1997). We explore this puzzling outcome by comparing the competitive behavior of female and male participants in the two village groups. In *further* villages we indeed find that female participants are more likely to shy away from competition, consistent with literature on gender and competitiveness (Croson and Gneezy, 2009): 43.45 percent of females and 53.18 percent of males opt into competition. A chi-squared test rejects the null hypothesis at $p < 0.05$. Conversely, in *near* villages 56.00 percent of females and 53.69 percent of males opt into competition. This difference is not significant ($p > 0.6$). Fig. 4 depicts the results.

To better understand what might be driving these results, we run a logit regression disaggregated by gender and control for the same socioeconomic variables as in Table 2.

Table 3 reports the results for male participants in the first two columns and for female participants in the last two columns. This time, we find that male participants' competitive behavior is determined by

¹⁵ As an anonymous reviewer pointed out, the size of the exogenous large-scale farm exposure effect may indeed be measured conservatively, because we cannot rule out (spillovers such) that some villagers commuted to the large-scale farms which were 50-70km away. If this is the case, then our regressions would underestimate the effect of the large-scale farms.

¹⁶ This is also not the case in a pairwise correlation of the asset index and the decision to compete ($p > 0.1$).

¹⁷ While our asset index is supposed to capture differences in *realized* income and wealth, it does not capture differences in *potential* income opportunities that large-scale farms typically provide. Such opportunities alone may influence risk-taking as well.



Fig. 3. Competitive choices of adults by village group. Note: error bars depict ± 1 SE.

market engagement (crop sales) while female participants' competitive behavior is driven by proximity to the large-scale farms.¹⁸ We no longer find that both crop sales and proximity to large-scale farms jointly affect competitive behavior.

This result on the heterogeneous effects of large-scale farm exposure and crop sales suggests that different mechanisms drive male and female competitive behavior. Comparing the males and females in our sample in Table A.1 in the appendix, we observe that the percentage of study participants who report that they are engaged in crop sales is balanced. However, despite the fact that there are no significant differences in crop sales across both sexes, endogenous market engagement through crop sales is only important for males. This difference is likely to be driven by prevailing norms and customs in rural Zambia that favor male participation in the labor and commercial agricultural markets and assign unpaid domestic and subsistence agricultural roles to women (Kajoba, 1997; Evans, 2017). Thus, even though the males and females in our study are both engaged in crop sales, males may be more proactive in these markets while females may have to balance crop sales along with agricultural work and other unpaid domestic activities.¹⁹

Examining the remaining socio-economic characteristics in Table A.1, we observe that males are more educated, own more assets and cultivate a more diverse selection of crops.²⁰ In addition, males are more likely to head households than females. This suggests that females are more economically disadvantaged than their male counterparts. Considering that males have significantly more productive resources and that there are multiple factors jointly affecting their competitive behavior (see Table 3), exogenous large-scale farm exposure may have a minimal effect on them since they already behave competitively. Thus, given the setting, it is reasonable that females are more responsive to

large-scale farm exposure as there are no other factors that simultaneously affect their competitive behavior.²¹

To further understand the mechanisms through which large-scale farm exposure affects females' competitive behavior, we interact the dummy variable that indicates a village is near a large-scale farm with females' socioeconomic characteristics. These results are reported in Table A.2 in appendix A. We do not find that females' competitive behavior is raised because large-scale farms increase females' asset holdings or paid employment opportunities. This indicates that other mechanisms are driving the observed effect.²²

A study that analyzes willingness to compete in rural and urban Uganda by Bjorvatn et al. (2016) finds a gender gap in competitiveness for rural areas but not for urban settings. The authors argue that these results are driven by the rural context where attitudes towards women differ. In a similar vein, considering that large-scale farms bring development opportunities to rural areas, it is likely that large-scale farm exposure raises females' awareness of opportunities that were previously unavailable and weakens the prevailing norms that are disadvantageous to women. Evidence for an analogous effect in Zambia is provided by Evans (2017) who uses ethnographic data from a rural and urban setting in the Luapula and Copperbelt provinces and finds that rural women's exposure to other women who are engaged in socially valued, masculine roles erodes gender ideologies.

Overall, we can conclude that large-scale farm exposure in our rural setting levels the competitive behavior of females and males. Using the measure of Gneezy et al. (2009), the effect is so large that it closes the commonly associated gender gap. This finding may provide an

¹⁸ A simple regression analysis reveals that opting for competition increased payoffs of both women and men who decided to do so significantly ($p < 0.01$, by about 50 percent).

¹⁹ Crop sales are reported as a binary variable. We cannot estimate the intensity of male and female sales.

²⁰ The more diverse crop selection is indicated by the higher value of the crop index based on a principal component analysis. Males tend to cultivate a more diverse mix of cash and staple crops.

²¹ In order to investigate whether the two main results obtained on large-scale farm exposure reported in Tables 2 and 3 are robust, we change the specification of our main variable of interest from a dichotomous variable (near vs. further) to a continuous variable that indicates the distance away from the large-scale farm (in kilometers). All other individual, household and village-level socio-economic controls from the previous specifications are retained. The results are reported in Table A.4 and A.5. We find that an increase in the distance away from the large-scale farms significantly reduces the likelihood for a competition choice. This corroborates our result that proximity to a large-scale farm increases competitive behavior.

²² Note that smallholders working on large-scale farms are not more likely to compete in the competition game, as shown in our regression analysis in Tables 2 and 3 above. It is also not the case that there is a significant interaction effect for female workers vs. female non-workers (see Fig. A.2 in Appendix A).

Table 2
Regression analysis of adults' competitive behavior.

Dependent variable: decision to compete	I	II	III
Independent variables	Logit with individual controls	Logit with individual and village controls	Logit with individual and village controls, reduced (0.045)
<i>_near</i> village = 1	0.107*** (0.041)	0.162*** (0.037)	0.127*** (0.045)
Household sells crops = 1	0.127** (0.52)	0.134** (0.058)	
Household head = 1	0.022 (0.049)	0.026 (0.053)	0.030 (0.049)
Age (continuous)	−0.0001 (0.001)	−0.0007 (0.002)	−0.0004 (0.001)
Male = 1	0.035 (0.053)	0.047 (0.059)	0.036 (0.056)
Education in years (continuous)	0.003 (0.006)	0.003 (0.008)	0.001 (0.007)
Large-scale farm worker = 1	−0.010 (0.041)	−0.004 (0.044)	−0.009 (0.042)
Migrated after large-scale farm = 1	−0.029 (0.040)	−0.020 (0.041)	−0.028 (0.040)
Asset index based on pca	0.024 (0.107)	0.081 (0.116)	0.094 (0.109)
Crop index based on pca	−0.140 (0.182)	0.049 (0.054)	−0.089 (0.179)
Land title = 1	0.039 (0.050)	0.049 (0.054)	0.072 (0.055)
Village area (continuous)		0.00001 (0.00001)	0.00001 (0.00001)
# of ethnic groups (continuous)		−0.010 (0.009)	−0.012 (0.009)
Village is patrilineal = 1		0.131*** (0.047)	
Region dummy		−0.031 (0.048)	0.054 (0.047)
Observations	787	721	787

Note: The table presents marginal effects at the means of the independent variables. The observations from the *_further* control villages are the baseline of the estimations. The standard errors in parentheses are clustered at the village-level in all estimations. The reason for the difference between Regressions I and III compared to Regression II (787 vs 721 observations) is that for three villages (out of the 29) we do not have clear, unambiguous information on whether the village is patrilineal or matrilineal. Statistical significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

additional element in the quest for measures to overcome gender differences (e.g. Balafoutas and Sutter, 2012; Niederle et al., 2013).

4.2. Children

Next, we complement our analysis of adults' competitive behavior with children's behavior. Analyzing children's behavior is interesting, as they may be more receptive to short-term changes in their environment. While adults may have developed their preferences over decades, children are at the prime of their preference formation (Sutter et al., 2019).

We find a similar effect of large-scale farm exposure: there is a significantly higher fraction of young participants who decide to make

competitive choices in *_near* villages compared to *_further* villages (63.09 percent vs. 42.26 percent respectively, two-sided Fisher's exact test: $p < 0.001$).²³ Examining the results of female and male children separately, we find that both genders are more competitive in *_near* villages compared to *_further* villages (see Fig. 5). Analogous to the results that we obtained for adults in Fig. 4, we find a large gender gap in competitiveness for *_further* villages (52.08 percent for males vs. 29.17 percent for females, chi-squared test: $p < 0.01$), but not for *_near* villages (62.72 percent for males vs. 63.41 percent for females, (chi-squared test: $p > 0.9$). Controlling for all other available variables regarding the children (age, number of scored tennis balls in the competition game and region of data collection) in a logit regression analysis confirms these results (see Table A.3 in appendix A for details).²⁴

5. Follow-up survey: Intra-household tasks and role models

It is likely that children's competitive behavior is influenced by that of adults, especially parents (Almas et al., 2016; Falk et al., 2021; Khadjavi and Nicklisch, 2018). Mothers engaged in paid employment may act as role models and pass on their competitive traits to their daughters in *_near* villages – as a consequence, competitive behavior may become more prevalent among girls. This transmission channel is in line with existing literature that points out how children's competitive behavior is shaped by role models and norms (e.g. Andersen et al., 2013), yet before such conclusions can be drawn for our study, more data that explains these transmission mechanisms is required.

In July 2018 we returned to one *_near* and one *_further* village in the Mumbwa region, to collect more qualitative information that would enable us to potentially identify underlying mechanisms. We administered a follow-up survey to a subset of 59 participants in these two villages.²⁵ The goal of this follow-up exercise was to identify any mechanism that could potentially explain the significant and unanticipated effects on women's and girls' competitive behavior.

We included questions on the intra-household division of tasks to learn about how male and female household members allocate their time (hours per day) in *_near* and *_further* villages and to examine whether there are any potential role model effects that might influence children's competitive behavior.²⁶ Table 4 presents pairwise correlations of the gender variable with different intra-household tasks. It is evident that the gender-division of these tasks do not differ significantly between the two villages, with one prominent exception: *looking after children*. Table 5 provides further evidence for this difference while controlling for the level of hours and age of the respondent. F-tests find no joint statistical significance of the variables "near villages" and the interaction term of near*female ($p = 0.55$ and $p = 0.61$ respectively).

Hence, while in the *_further* village looking after children is a predominantly traditional female role, there is no detectable gender difference for this household task in the *_near* village. Given that twice as many women are engaged in paid employment on large-scale farms in *_near* villages, it seems that women and men in such villages need to share the household tasks more. There is supporting qualitative evidence that men may indeed take up child caring responsibilities in a study conducted in rural Zambia (Seur, 1992). Seur (1992) analyses how

²³ Note that we designed our procedures in a manner such that it was not possible for young participants to observe or be told by their parents what decision to make. Parents and other young participants also did not watch the decision and ball throwing of young participants.

²⁴ Other information on children's socioeconomic variables was not collected due to ethical and time considerations.

²⁵ Unfortunately, time and budget restrictions prevented us from conducting the follow up survey with a larger group of former participants.

²⁶ The questions on intra-household allocation of tasks were taken from Glennerster et al. (2018) and modified for our study context. The questions that Table 4 is based on are presented in Appendix C.

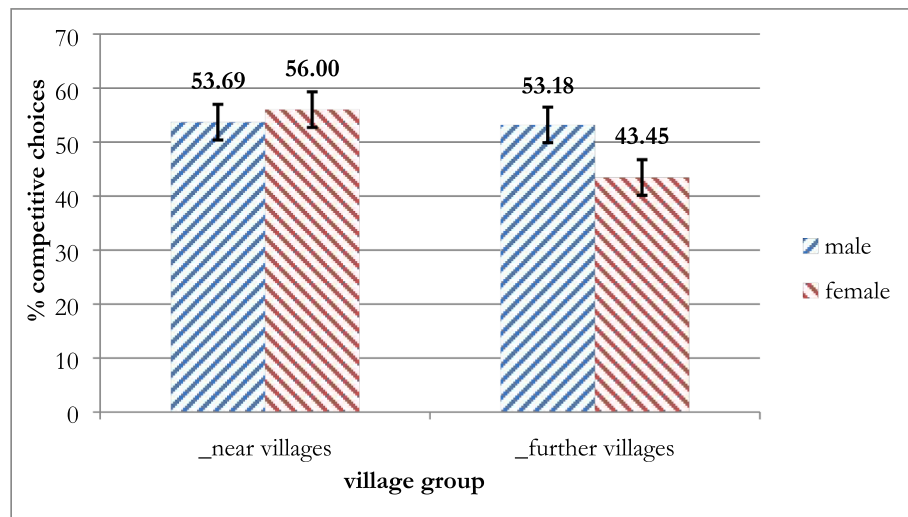


Fig. 4. Competitive choices by village group and gender. Note: error bars depict ± 1 SE.

Table 3
Regression analysis of adults' competitive preferences by gender.

Dependent variable: decision to compete	IV	V	VI	VII
Independent variables	Logit (Males)	Logit (Males)	Logit (Females)	Logit (Females)
_near village = 1	0.034 (0.051)	0.076 (0.056)	0.141** (0.063)	0.210*** (0.068)
Household sells crops = 1	0.180*** (0.056)	0.149** (0.067)	0.070 (0.066)	0.118 (0.072)
Household head = 1		0.084 (0.083)		-0.016 (0.064)
Age (continuous)		-0.002 (0.002)		-0.000 (0.002)
Education in years (continuous)		0.007 (0.009)		-0.002 (0.009)
Large-scale farm worker = 1		0.027 (0.062)		-0.043 (0.056)
Migrated after large-scale farm = 1		0.009 (0.060)		-0.044 (0.064)
Asset index based on pca		0.088 (0.167)		-0.020 (0.157)
Crop index based on pca		-0.022 (0.170)		-0.313 (0.266)
Land title = 1		0.139* (0.078)		-0.001 (0.071)
Village area (hect., continuous)		0.000* (0.000)		0.000 (0.000)
# of ethnic groups (continuous)		-0.009 (0.013)		-0.013 (0.012)
Village is patrilineal = 1		0.128** (0.059)		0.117 (0.104)
Region dummy	-0.031 (0.051)	-0.026 (0.072)	0.032 (0.065)	-0.029 (0.110)
Observations	419	347	423	374

Note: The table presents marginal effects at the means of the independent variables. The observations from the *_further* control villages are the baseline of the estimations. The standard errors in parentheses are clustered at the village-level (29 villages) in all estimations. Statistical significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

gender dynamics play out once women are engaged in commercial agriculture. The results suggest that husbands take care of children when mothers are away for business.

With regard to children's competitiveness, it may well be that mothers engaged in paid employment in *_near* villages act as role models for daughters to become more competitive. Evidence for such a mechanism is provided in a study in Zambia's Copperbelt Province, where

Evans (2014) observes that once women begin to work, especially in jobs that are perceived to be masculine, they also start to encourage their daughters to pursue gender-atypical careers. However, based on the evidence in Tables 4 and 5, it might just as well be that children's competitiveness is higher, because fathers are spending more time with their daughters and also act as role models. This channel is well-documented in psychological research (Rohner and Veneziano, 2001; Lamb, 2004; Cooper, 2009) and recently received attention in economic research on women's labor market participation and gender-role identity (Hellerstein and Morrill, 2011; Olivetti et al., 2020). While we regard our follow-up survey as indicative of this mechanism, we recommend further thorough exploration of this mechanism, which we regard as understudied in economics.

6. Conclusion

Our investigation concentrates on the encounter of two economic systems which are at extremes along the dimension of agricultural production. There is peasant, small-scale farming on the one hand and capital-intensive market-oriented large-scale farming by the global agricultural industry on the other hand (Timmer, 1997). Our results suggest that living in the proximity of large-scale farms predicts smallholder's competitive behavior. We regard this finding as highly important for the broader understanding of what kind of societal arrangements may shape preferences (Bowles, 1998).

In small-scale farming communities located further away from large-scale farms we find the commonly observed gender gap in competitiveness (Gneezy et al., 2003; Croson and Gneezy, 2009), i.e. that males are more competitive than females. Conversely, the gender gap is completely closed in small-scale farming communities near large-scale farms. This finding suggests that proximity to large-scale farms might not only increase competitive behavior of smallholders in general, but also that females' competitive behavior 'catches up' with that of males. Further data from a subsequent survey suggests that female engagement in paid employment causes a shift in the gender division of intra-household tasks and especially indicates that fathers caring for their children might serve as role models for their daughters—thus leading to greater competitiveness of girls. This mechanism stresses the importance of women's empowerment and participation in the labor market.

A large body of literature argues that competitive behavior is key to succeed in market environments and that females' reduced competitiveness explains their lower incomes and participation in leadership positions (Niederle and Vesterlund, 2007; Buser et al., 2014). Accordingly, balancing competitive behavior of females and males through

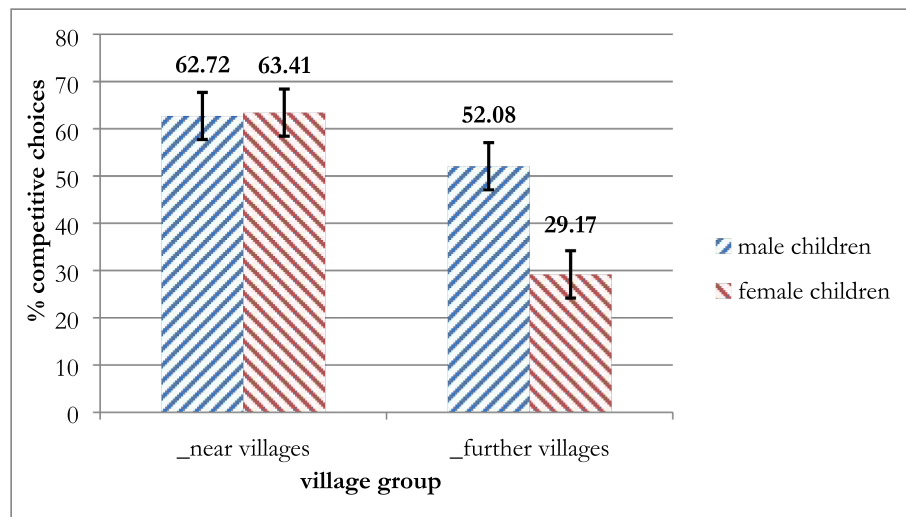


Fig. 5. Competitive choices of children by gender and village group. Note: error bars depict ± 1 SE.

Table 4

Pairwise correlations of gender with household tasks.

	_near village Gender, 1 if female	_further village Gender, 1 if female
Tending animals	-0.3324	-0.0520
Tending garden/field	-0.2619	0.0688
Selling crops at market	0.0446	-0.0556
Selling crops at road	0.3058	0.0536
Leisure	-0.3049	-0.1649
Cooking	0.5044	0.4652
Collecting water	0.4146	0.3752
Cleaning the home	0.5902	0.6050
Washing clothes	0.5924	0.6120
Looking after children	-0.1098	0.4319
Gathering firewood	0.1504	-0.0224

Note: Pairwise correlations statistically significant at $p < 0.05$ in **bold**. The questions we asked are listed in Appendix C.

Table 5

OLS Regressions explaining "Looking after children".

Dependent variable: hours per day looking after children			
Independent variables	OLS	OLS	
_near village = 1	2.214 (1.560)	1.825 (1.742)	
female = 1	3.027** (1.379)	3.294* (1.677)	
Interaction term _near*female	-3.955* (2.082)	-4.142* (2.347)	
Age (continuous)		-0.032 (0.037)	
Constant	2.286** (1.007)	3.939** (1.828)	
Observations	54	47	

enhanced market engagement in the rural setting of developing countries may be regarded as a valuable positive externality. In the specific case of rural Zambia, we believe that shifting female smallholders' preferences towards greater competition may increase their market participation and thereby enable them to benefit from spillovers from large-scale farms such as increased employment, market access and yield that have been documented in the literature (Lay et al., 2021; Sitko et al., 2018; Wineman et al., 2021).

CRedit authorship contribution statement

Menusch Khadjavi: Conceptualization, Methodology, Validation, Formal Analysis, Data Curation, Writing – Original Draft, Writing – Review & Editing, Visualization, Supervision, Project administration, Funding acquisition. **Kacana Sipangule:** Conceptualization, Methodology, Validation, Formal Analysis, Data Curation, Writing – Original Draft, Writing – Review & Editing, Visualization, Supervision, Funding acquisition. **Rainer Thiele:** Conceptualization, Methodology, Writing – Original Draft, Writing – Review & Editing, Supervision, Project administration, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data and replication files are freely available using this permanent link: <https://doi.org/10.34894/MROP8A>.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.worlddev.2023.106519>.

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